

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

Division of Fish and Wildlife
Marine Fisheries

2006 Management Plan for the Crustacean Sector

Developed in association with the
Commercial fishing licensing provisions set forth in the
“Rules and Regulations Governing the Management of Marine Fisheries”

*******DRAFT#1*******

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Rhode Island Crustacean Fishery Management Plan 2006

Introduction:

Rhode Island general law pertaining to commercial fishing licenses requires that the Director of DEM develop conservation and management plans in support of regulations that may restrict the issuance of licenses (RIGL 20-2.1-9(5)). Restrictions on commercial licenses were clearly contemplated by the Rhode Island General Assembly as a means to limit fishing effort and to rebuild depleted fishery resources (RIGL 20-2.1-2, 20-3.1-2 (4)). Such plans are to be developed with advice from the Rhode Island Marine Fisheries Council and shall focus on fishery resources with the greatest value to the state. The current DEM commercial licensing program recognizes three fishery sectors; crustaceans, finfish, and shellfish. The following is the plan for the crustacean sector with recommendations for licensing in 2006. Two crustacean sector license endorsements, lobster and crustaceans other than lobster (crabs) are offered by DEM and are considered here. This plan emphasizes American lobster in recognition of their great commercial and recreational value to Rhode Island citizens. The 2005 licensing plan recommended no new lobster licenses in view of the poor resource status and ongoing management activities designed to rebuild the lobster resource in the Rhode Island area.

American Lobster:

Stock Status and Rebuilding Potential- The lobster resource in Narragansett Bay and Rhode Island coastal waters has been over exploited for some time (ASMFC 1996, 2000, Gibson 2000). A recent stock decline prompted the Atlantic States Marine Fisheries Commission (ASMFC) in 2002 to initiate remedial action in lobster management Area 2 which includes Rhode Island state waters. An ASMFC subcommittee of lobster biologists and stock assessment scientists was convened to examine the problem and in January of 2003, issued a report that recommended reducing lobster landings in area 2 by 73% (ASMFC 2003a). In February 2003, the ASMFC adopted an accelerated minimum gauge schedule for Area 2 by emergency action. In addition, development of addendum IV to the ASMFC lobster fishery management plan was authorized by the management board. It was adopted in the fall of 2003 with an implementation date of June 1, 2005. Important elements of addendum IV included increases in minimum legal size, increases in escape vent dimensions, and an effort control program. The initial effort control plan offered by industry was deemed inadequate and rejected by the ASMFC. Additional guidance to the Area 2 states from the ASMFC on effort control was provided at the August 2004 and May 2005 lobster management board meetings. A key requirement for the revised plan was that trap effort should be capped at or near current levels with the possibility of adjustments pending new stock assessment results. "At or near current level" was clarified to mean within 20-30% of 2003 trap deployments as recorded in industry logbooks. Addendum VII is currently under development and will employ a history based effort limitation approach along with provisions that allow for transfers of pots between businesses.

Agency trawl surveys clearly document the abundance decline that triggered the ASMFC emergency action in Area 2. Rhode Island Division of Fish and Wildlife (RIDFW) surveys conducted in Narragansett Bay and Rhode Island coastal waters since 1979 show that local lobster abundance dropped from high levels in the mid-1990's to low levels in 2002-2003 (Figures 1). Although trawl surveys in 2004 caught more lobster than a year ago, abundance has not recovered to former levels. URI scientists observed a similar pattern in lobster catches made by the Graduate School of Oceanography survey (Figure 2). The decline in abundance of both sub-legal and legal lobster from 1997 to 2002 was preceded by a steep decline in the abundance of newly settled lobster from 1990 to 1996 (Figure 3). New settlers descend to the bottom from the plankton each summer having been hatched from eggs carried by females the preceding year. These observations are consistent with the generally accepted time lag of 6-7 years between first settlement and attainment of adult size. The available data indicate that declining abundance at the youngest benthic stage began early in the decade before the 1996 North Cape oil spill and the 1997 outbreak of shell disease, reducing recruitment to the adult stock. It is not clear why settlement declined although it was coincident to over fishing which reduced stock reproductive potential (ASMFC 1996, 2000). A shortage of local egg production is unlikely the cause as trawl surveys and fishery sampling showed above average abundance of mature size lobster. Declining settlement was however correlated with a downturn in the North Atlantic Oscillation index (Figure 4). The NAO index measures the difference between barometric pressure in Iceland and the Azores (Drinkwater and Mountain 1997). A positive pressure differential is associated with strong westerly winds across the North Atlantic Ocean, a condition that could facilitate delivery of surface larval lobster from offshore to inshore areas. Katz et al. (1994) showed through analysis of ocean currents and larval behavior that such a subsidy was possible. Further, shell disease, the oil spill, and increasing predation by finfish have likely increased natural mortality rate and reduced the number of lobster surviving from settlement to legal size. The combined effects of reduced settlement and post-settlement survivorship have impacted the fishery, reducing recruitment, landings and catch per unit effort (CPUE) to low levels (Figure 5). It is worth noting that juvenile settlement improved to average levels in 1997-1999 (Figure 3). Given the time lag from settler to adult, an increase in legal abundance may occur in 2004-2006 unless natural mortality increases further. The increased catch rate of short lobster in agency trawl surveys and fishery monitoring in 2003-2004 is encouraging.

The ASMFC lobster technical committee is updating the coast wide lobster stock assessment including evaluation of new models that can consider increased natural mortality rate. The assessment should be finished for peer review in summer of 2005 and will address the US lobster resource from New Jersey to Maine. To support Rhode Island 2006 licensing recommendations as required under RIGL 20-2.1-9, the Gibson (2000) biomass dynamic model (BDM) assessment for lobster in the Rhode Island area was updated. This is a preferred method for assessing stocks for which age determination is difficult. In addition to estimating stock size and fishing mortality rates (F), a BDM estimates biological reference points based on maximum sustainable yield (MSY). Data required are a time series of fishery landings and a biomass index along with any auxiliary estimates of F or stock biomass to tune the model. Biomass dynamic models are

a mass balance approach in which stock biomass in a new year is the sum of last year's biomass plus new production minus the catch removed (Hilborn and Walters 1992). New production is the net balance between additions from growth and recruitment and losses from natural causes. Application of the BDM to data for the Rhode Island inshore lobster fishery revealed that F has declined in recent years (Figure 6). Landings for 2005 are not available so the 2004 estimate of F is the most recent and is very close to that associated with MSY . Fishery managers generally set a target F below F_{msy} as a prudent objective in the face of uncertainty so over fishing has been occurring since 1998. The recent decline in F however is encouraging and consistent with data showing that fishing effort is declining. Three independent data sets, pots fished as recorded in industry logbooks, pot-hauls estimated from landings and observer CPUE, and trap tags ordered by industry; show that effort is at the lowest level in over a decade (Figure 7). Stock biomass (B), while trending upward recently, remains well below that needed for MSY (Figure 8). A resource is considered over fished until B exceeds B_{msy} . Over fishing is distinguished from over fished in a temporal sense with the former representing current removal rate vs. its MSY reference level while the latter represents past removal rates that have lowered B below its MSY reference level.

Projections of stock size into the future indicate that the stock cannot rebuild to the B_{msy} reference level in a reasonable time period while F is near F_{msy} (Figure 9). A reasonable time period is defined as 10 years, consistent with the Sustainable Fisheries Act. More rapid stock rebuilding to B_{msy} is possible if F is reduced substantially below current levels. A 50% reduction in F would allow for biomass recovery in 5 to 6 years (Figure 10). While industry attrition has clearly reduced fishing mortality from 1999 to 2004, additional reductions are needed to reduce it sufficiently below F_{msy} to allow for timely biomass recovery. These stock status and rebuilding conclusions were robust to consideration of increasing natural mortality rate (M) in the BDM. Assessment runs that allowed M to triple from 1997-2004 in accordance with the outbreak of shell disease showed that reductions in F need to be greater to improve resource condition than if M is assumed constant. Persistent high M however will limit the rebuilding that can occur.

Management Program- Lobsters are managed within state waters by the Rhode Island Department of Environmental Management (RIDEM) with advice from the Rhode Island Marine Fisheries Council and RIDFW. Regional management of the lobster resource is the responsibility of the ASMFC. Amendment 3 to the fishery management plan (ASMFC 1997) and associated addenda govern the interstate management program and a peer reviewed coast wide stock assessment (ASMFC 2000) provides information on lobster biology and resource status. The ASMFC management program is organized by lobster management area with Rhode Island state waters part of Area 2. RIDEM complies with the Area 2 plan through a set of management measures that includes minimum gauge and escape vent sizes, trap limits, and protection of egg-bearing females. Both state (RI-MA) and federal waters are included in Area 2 making cooperative management essential. The current plan for Area 2 required a reduction in trap deployment to 800 in addition to a set of gauge and escape vent size increases in order to rebuild egg production to the minimum F10% level. As noted above, these measures have been augmented with additional restrictions via the ASMFC addendum process. Notably, a

transferability based effort reduction program is under development and expected to reduce the amount of traps deployed over time. Details of the program are contingent on the forthcoming coast wide lobster stock assessment which is expected to provide regional estimates of F in comparison to new biological reference points.

Fishery Management Goals and Objectives -

Goal- The following goal is adapted from the coast wide goal of the Atlantic States Marine Fisheries Commission (ASMFC 1996).

Rhode Island will have a healthy American lobster resource and a fishery management regime which provides for sustainable harvest, cooperative management by stakeholders, and appropriate opportunities for fishery participation.

Objectives-

1. Maintain fishing mortality rates and brood stock abundance at levels which minimize the risk of stock depletion and recruitment failure.
2. Extend size-age composition of the resource and increase yield per recruit in the fishery while maintaining harvest at a sustainable level.
3. Maintain existing social and cultural characteristics of the fishery wherever possible
4. Promote economic efficiency in harvesting and use of the resource
5. Provide for adaptive management that is responsive to unanticipated short term events or circumstances.
6. Increase understanding of American lobster biology and improve data collection, stock assessment models, and relationships between harvesters and scientists.

Licensing Options and Recommendations-

Current Rhode Island lobstermen fishing in state waters must hold multipurpose or lobster principal effort fishing licenses to fish at full effort levels as allowed for by existing state and ASMFC regulations. The licensing statutes require that the Director of DEM specify by rule the status of the lobster resource each year and the availability of new lobster licenses. A limited number of individuals were issued limited access, basic commercial fishing licenses in 2003. These licenses allowed for a 100 pot deployment rather than the 800 pot, full access deployment. No licenses were recommended or issued by RIDEM for 2004 and 2005. Licensing renewal data for 2003-2005 show a similar level of attrition as the fishing effort data given above (Table 1). Between 2003 and 2005, there has been an 11% decline in the number of licenses applicable to lobster.

RI Marine Fishery Council Advice- *Not yet available*

RIDFW Recommendations- It is clear from the above information that the local lobster resource is over fished and has undergone a decline in abundance and fishery

performance. The decline has imposed substantial economic hardship on industry that has responded with attrition. Recently, the stock has shown signs of increase but biomass remains well below that needed for MSY. The regional rebuilding effort undertaken by the ASMFC has not yet been completed. Additional restrictions will be placed on existing fishers in 2005-2006 via Addendum VII to the interstate fishery management plan including a prohibition on issuance of new area 2 permits. This prohibition includes state lobster licenses and landing permits applicable to lobster. The finding of over fished resource status (biomass below B_{msy} level) is inconsistent with Rhode Island fishery conservation standard A of RIGL 20-2.1-9. In view of ASMFC compliance requirements and state law, it is recommended that no new lobster licenses be issued for 2006. The state should continue to work with the RIMFC and ASMFC to further reduce fishing mortality and to rebuild the lobster resource throughout the region. Attrition is clearly occurring in the industry and contributing to reduced fishing effort. The state should act to neutralize latent effort so that it cannot activate when resource conditions improve. It may be necessary to limit future participation based on historical performance to deal with latent effort. When stock status warrants and harvesting capacity matches resource productivity, exit-entry ratios for licenses should be developed in consultation with industry, the RIMFC, and the ASMFC.

Other Management Considerations-

Industry is working closely with the ASMFC and RIDFW to improve the effort control program and resolve the problems identified by the management board. Continued agency/industry cooperation is needed as implementation of transferability and historic participation schemes proceeds throughout the region. These programs, although controversial in some quarters, provide the best long-term mechanism to reduce lobster fishing effort. Industry has also expressed support for continuation and expansion of the North Cape v-notching program. Egg production by v-notched females has been a substantial component of local egg production in recent years. Evaluation of this program in the context of ASMFC stock rebuilding targets should occur. RIDFW has committed to a review of escape vent selectivity in particular, studies being conducted by industry. Upon review, recommendations will be made to ASMFC as appropriate. Finally, industry supports development of an un-vented trap survey to replace trawl surveys as the primary abundance monitoring tool for lobster. Supplemental federal funding to Rhode Island is forthcoming and will be used to implement a pilot pot survey along with the State of Massachusetts in 2006.

Other Crustaceans:

Stock Status- The commercial crab fishery in state waters is relatively small with landings of green, Jonah, rock, and blue crabs being made. Total Rhode Island landings of these species is currently about 2.3 million pounds and worth about 1.9 million dollars. However, only a small amount of this is taken from state waters. Landings of deep sea red crabs are also made but these come strictly from federal waters and participation is limited by federal permit. The local cancer crab stock was assessed by RIDFW for the

first time for this licensing cycle. Fishing mortality rate has recently approached the F_{msy} level (Figure 11) and should be monitored in the future. Biomass however was above the B_{msy} level so the Rock and Jonah crab resource is not considered over fished at this time (Figure 12). There is not sufficient data to assess other crab species in state waters at this time. The introduction of the Japanese shore crab (*Hemigrapsus sanguineus*) has been noted and may have as yet unknown consequences for other crab species.

The horseshoe crab, although not a true crab, is also harvested. Horseshoe crabs in Rhode Island were found to be over fished and at low abundance in the first RIDFW assessment (Gibson and Olszewski 2001). A commercial quota system with additional seasonal harvest restrictions has been instituted and landings have been reduced. An update of the stock assessment shows that while fishing mortality rate has been reduced to below the F_{msy} reference point, stock abundance has not yet recovered toward B_{msy} (Figures 13 and 14).

Management Program- Horseshoe crabs and crustaceans other than lobster are managed in state waters by the Department of Environmental Management with advice from the Rhode Island Marine Fisheries Council. The Department uses minimum sizes, seasons, quotas, and possession limits to manage the state waters fishery. Compliance with an ASMFC management plan is required in the case of horseshoe crabs and is achieved with a commercial quota and permitting system.

Fishery Management and Licensing Recommendations- No changes are recommended to the management program for horseshoe crabs and crustaceans other than lobster. Crab landings and abundance are stable and no new restrictions are needed. The spawning period closures have greatly restricted the horseshoe crab fishery and reduced fishing mortality rates. No additional limits are needed at this time. New commercial licenses for these species need not be limited and can have harvest levels equal to current licensees.

Literature Cited

Atlantic States Marine Fisheries Commission (ASMFC). 1996. A review of the population dynamics of American lobster in the northeast. Special Report No. 61 of the Atlantic States Marine Fisheries Commission.

Atlantic States Marine Fisheries Commission (ASMFC). 2000. American lobster stock assessment report for peer review. Stock assessment report No. 00-01 (Supplement) of the Atlantic States Marine Fisheries Commission. July 2000.

Atlantic States Marine Fisheries Commission (ASMFC). 2003a. Total allowable landings for area 2. Report of the ASMFC lobster modeling subcommittee, January 2003.

Atlantic States Marine Fisheries Commission (ASMFC). 2003b. Lobster conservation management area 2: goals and management measures. Report of the ASMFC lobster technical committee, July 2003.

Drinkwater, K.F. and D.G. Mountain. 1997. Climate and Oceanography. Pages 3-25 in J. Boreman, B.S. Nakashima, J.A. Wilson, and R.L. Kendall, editors. Northwest Atlantic groundfish: perspectives on a fishery collapse. American Fisheries Society, Bethesda Maryland.

Gibson, M.R. 2000. Alternative assessment and biological reference points for the Rhode Island inshore lobster stock with estimations of unfished stock size. Report to the Atlantic States Marine Fisheries Commission and lobster assessment peer review panel.

Gibson, M.R., and S. Olszewski. 2001. Stock Status of Horseshoe Crabs in Rhode Island in 2000 with Recommendations for Management. RI Division of Fish and Wildlife. Research Reference Document 01/01.

Hilborn, R., and C.J. Walters. 1992. Quantitative fisheries stock assessment choice, dynamics and uncertainty. Chapman and Hall, New York. 570 p.

Katz, C.H., J.S. Cobb, and M. Spaulding. 1994. Larval behavior, hydrodynamic transport, and potential offshore recruitment in the American lobster, *Homarus americanus*. Mar. Ecol. Prog. Ser. 103: 265-273.

Table 1- Rhode Island Lobster License Issuance Data 2003-2005

License Type	2003	2004	2005
Multipurpose Licenses	1191	1135	1075
% lobster declared	0.213	0.213	0.213
MPL for Lobster w/800 pot	254	242	229
Principal Effort Lobster w/800 pot	61	56	52
Commerical Lobster w/100 pot	50	48	41
Total Effective Lobster Licenses	321	304	287

Fig.1- Lobster Abundance in the RIDFW Seasonal Trawl Survey in Narragansett Bay and RI Coastal Waters

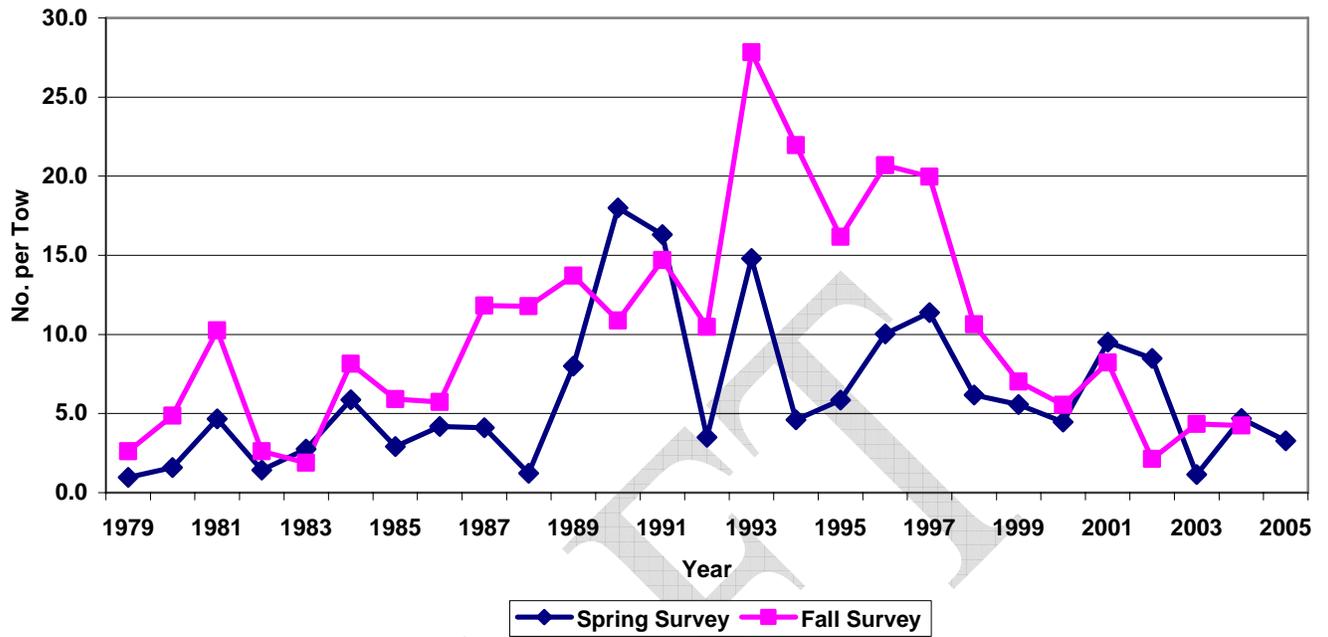


Fig.2- Lobster Abundance in the URIGSO Trawl Survey in Narragansett Bay and RI Coastal Waters

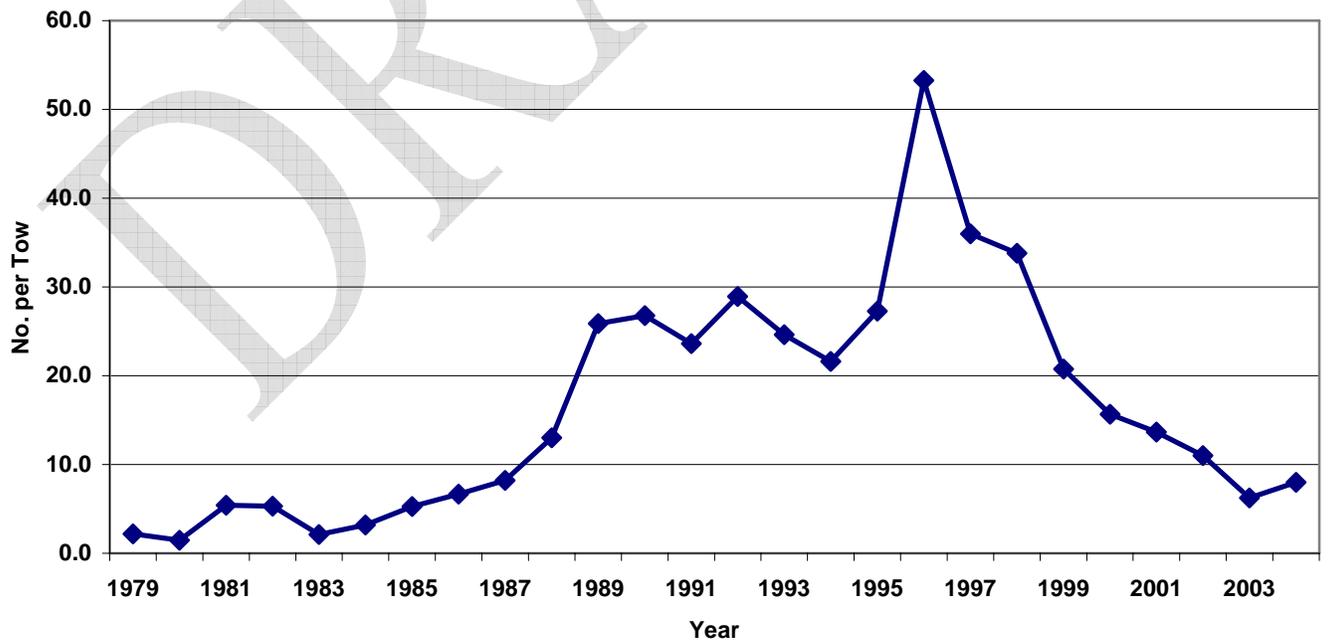


Fig. 3- Abundance of Newly Settled Lobster in Rhode Island from Wahle Dive Survey

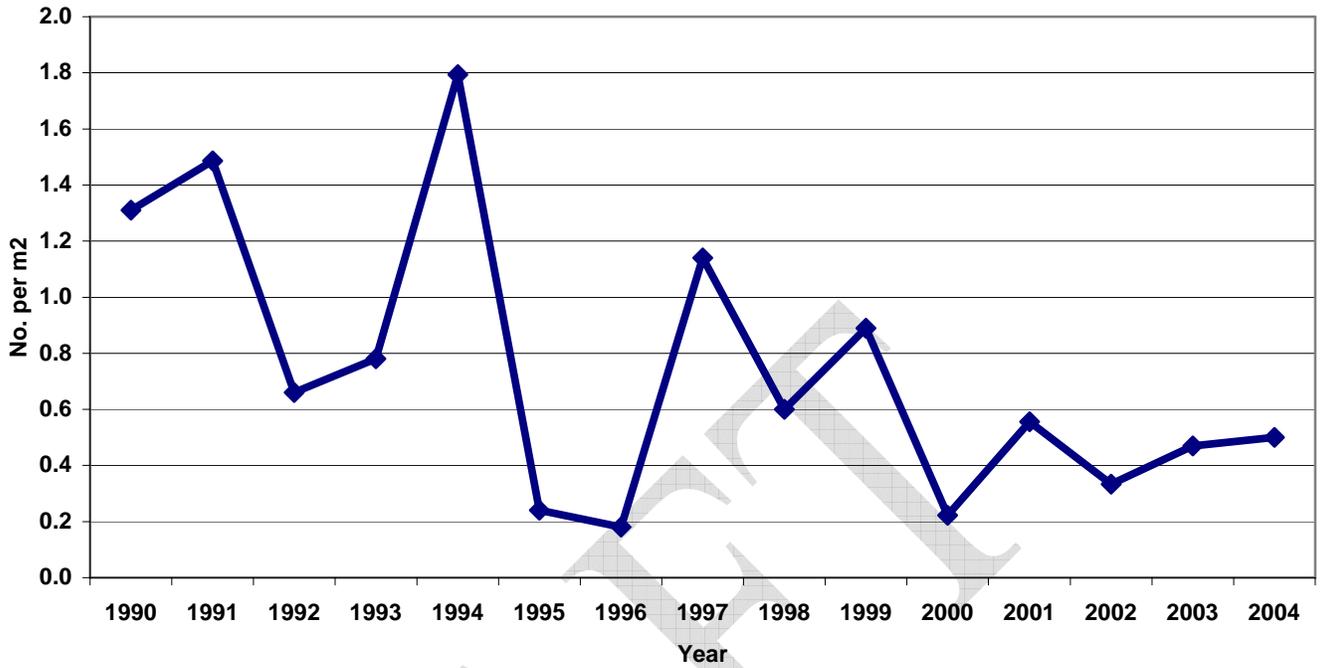


Fig.4- Correlation Between RI Lobster Settlement and Smoothed North Atlantic Oscillation Index

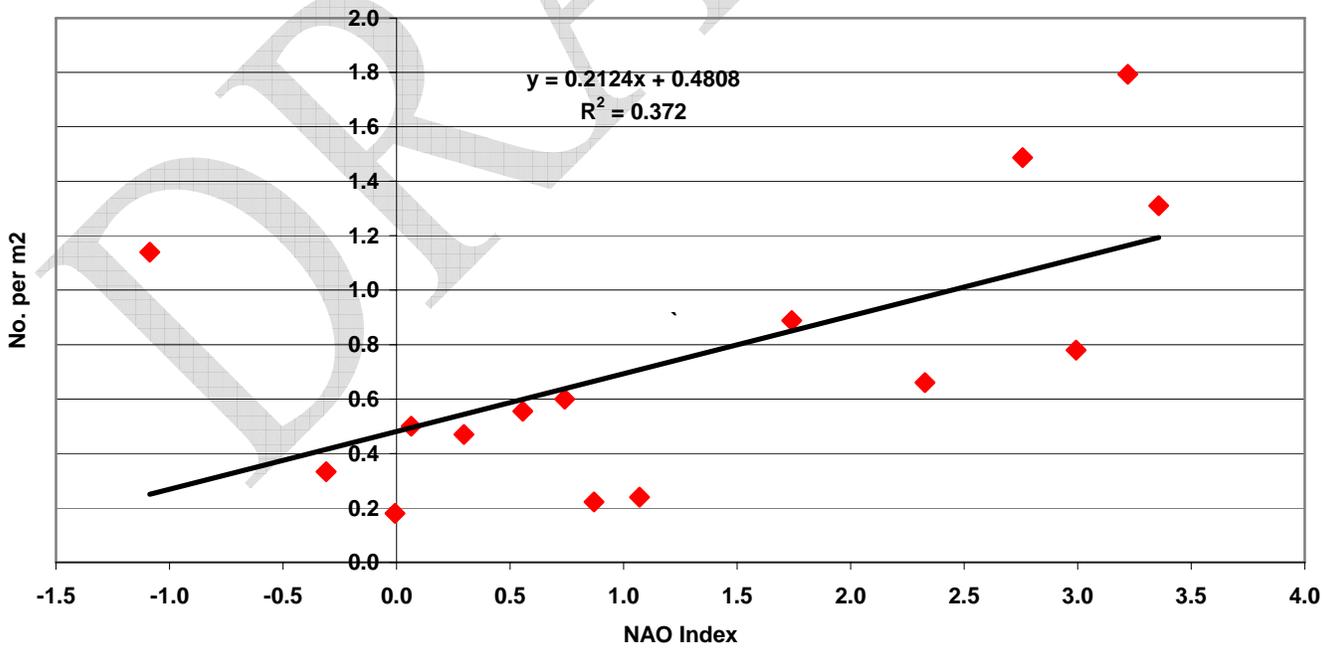


Figure 5- RI Inshore Lobster Landings and Fishery Catch per Unit Effort

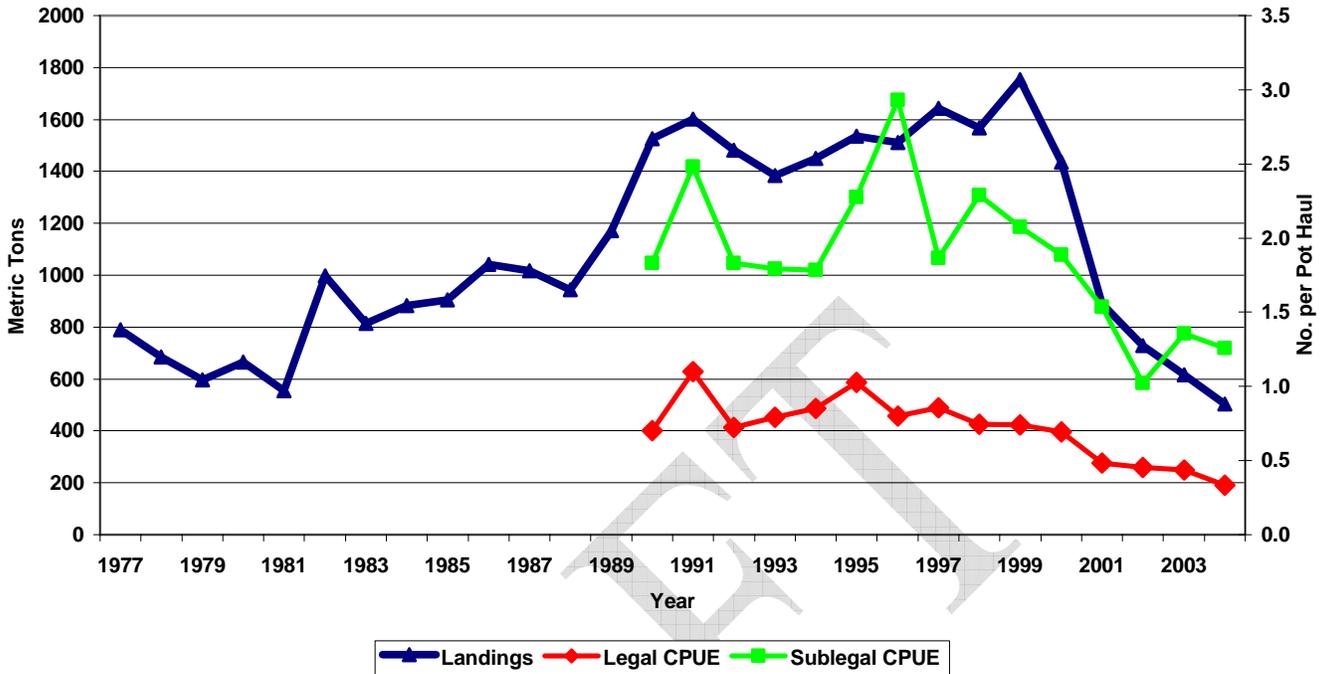


Fig.6- RI Inshore Lobster Fishing Mortality Rate from BDM Model Compared to MSY Level

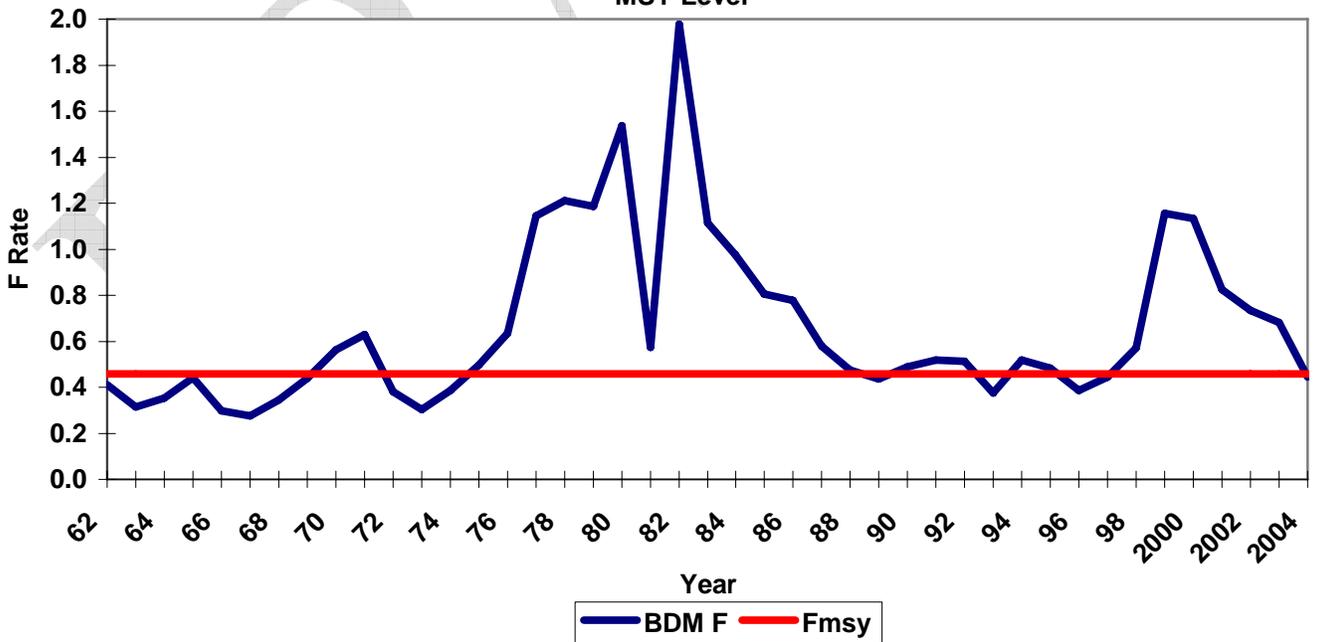


Fig.7- Number of RI Inshore Lobster Pots Fished from DFW Logbooks, Computed Pot-Hauls from Landings and Observer CPUE, and Tags Ordered by Fishermen

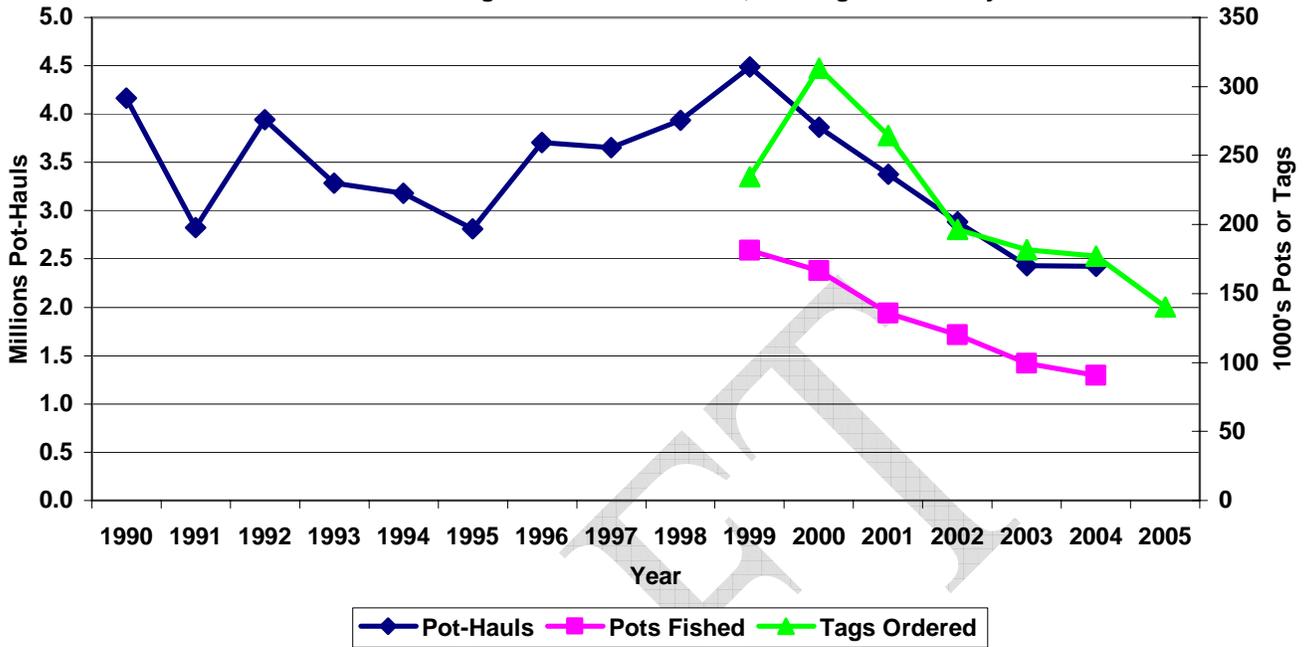


Fig.8- RI Inshore Lobster Absolute Abundance and Landings from BDM Model Compared to Bmsy

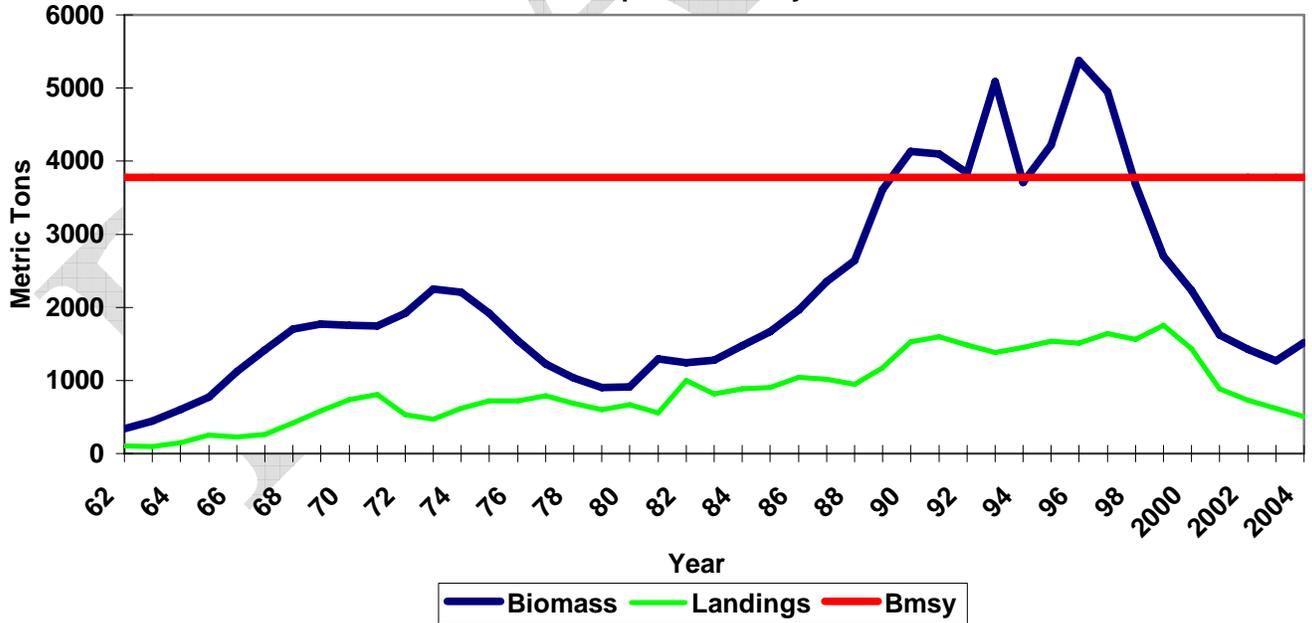


Fig.9- RI Inshore Lobster Stock Abundance and Landings Projection with Status Quo Fin 2005. Assumes Normal Stock Productivity

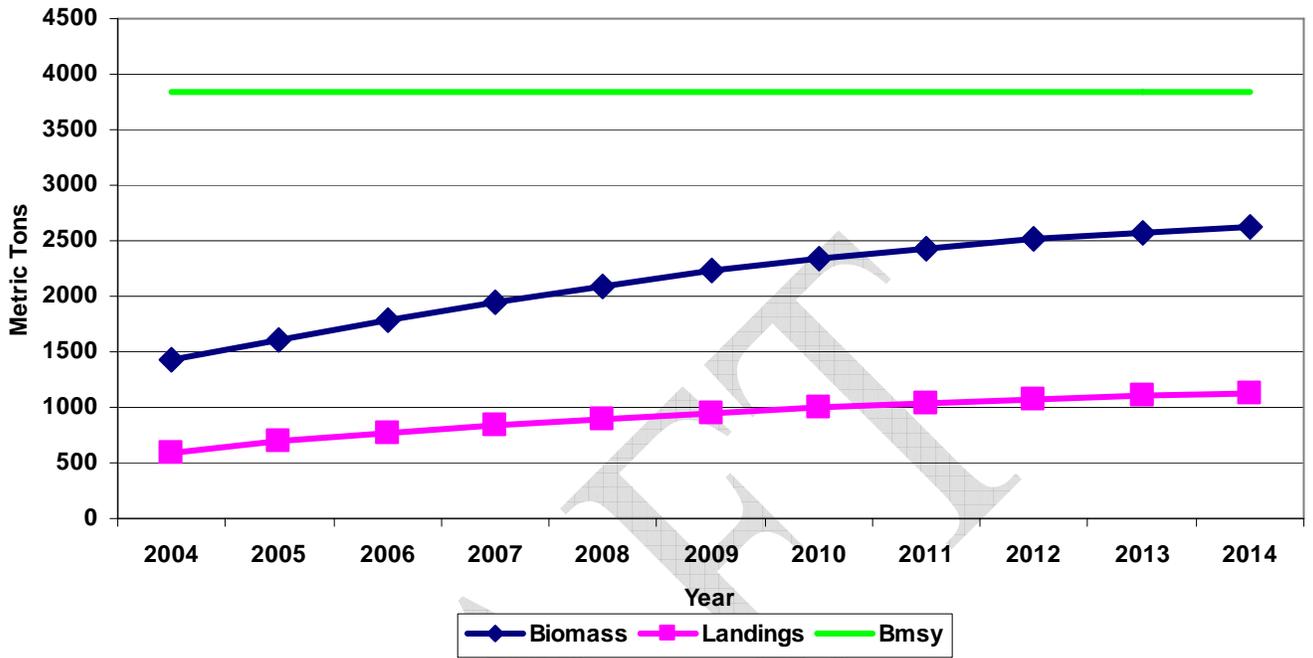


Fig.10- RI Inshore Lobster Stock Abundance and Landings Projection with 50% Reduction in F in 2005. Assumes Normal Stock Productivity

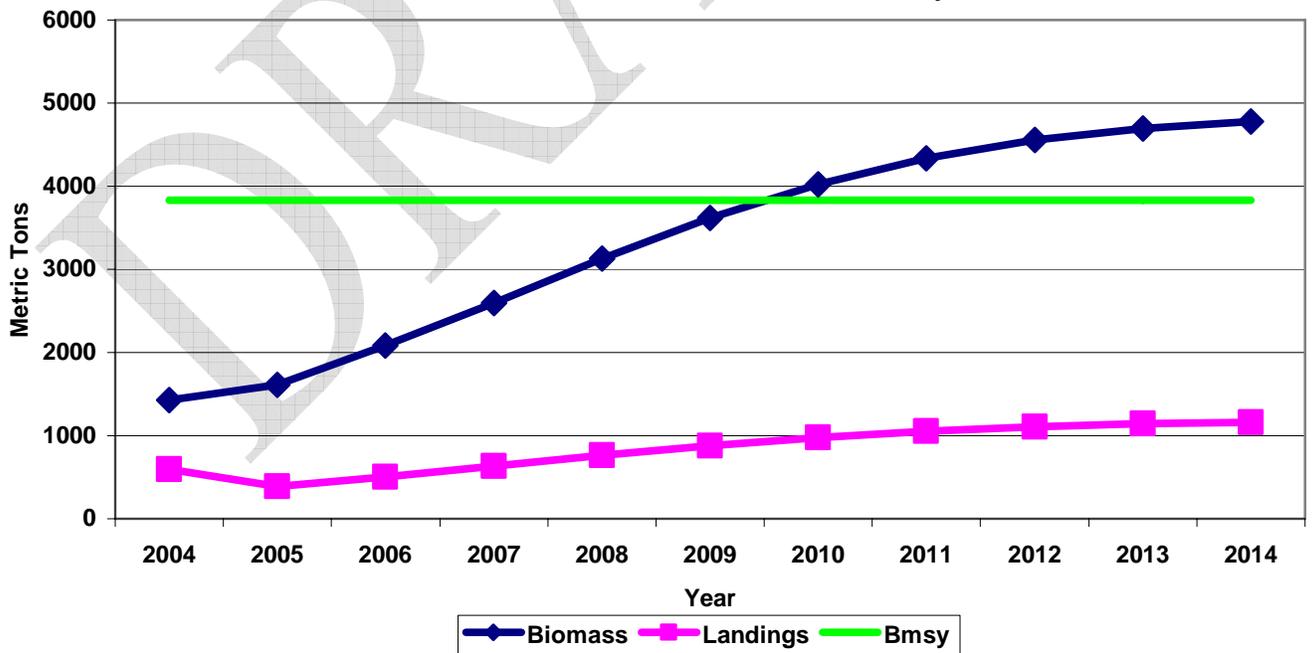


Fig-11- RI Cancer Crab Fishing Mortality Rate Compared to MSY Reference Level

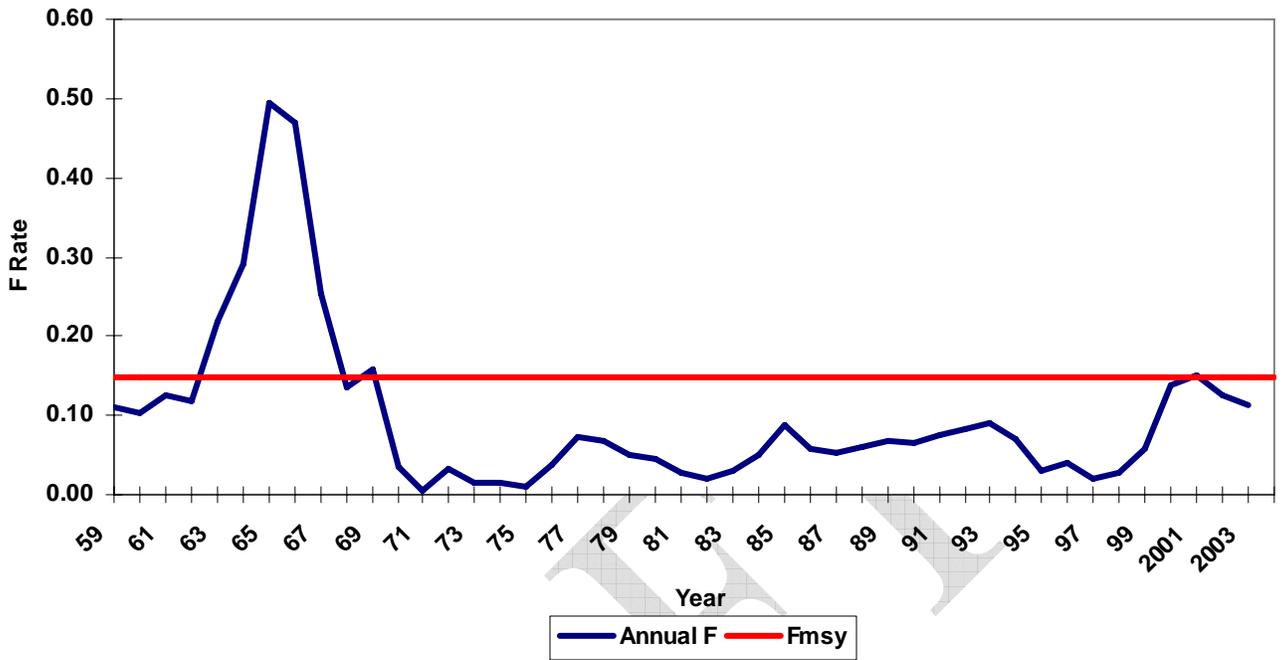


Fig.12- RI Cancer Crab Abundance and Landings Compared to MSY Reference Level

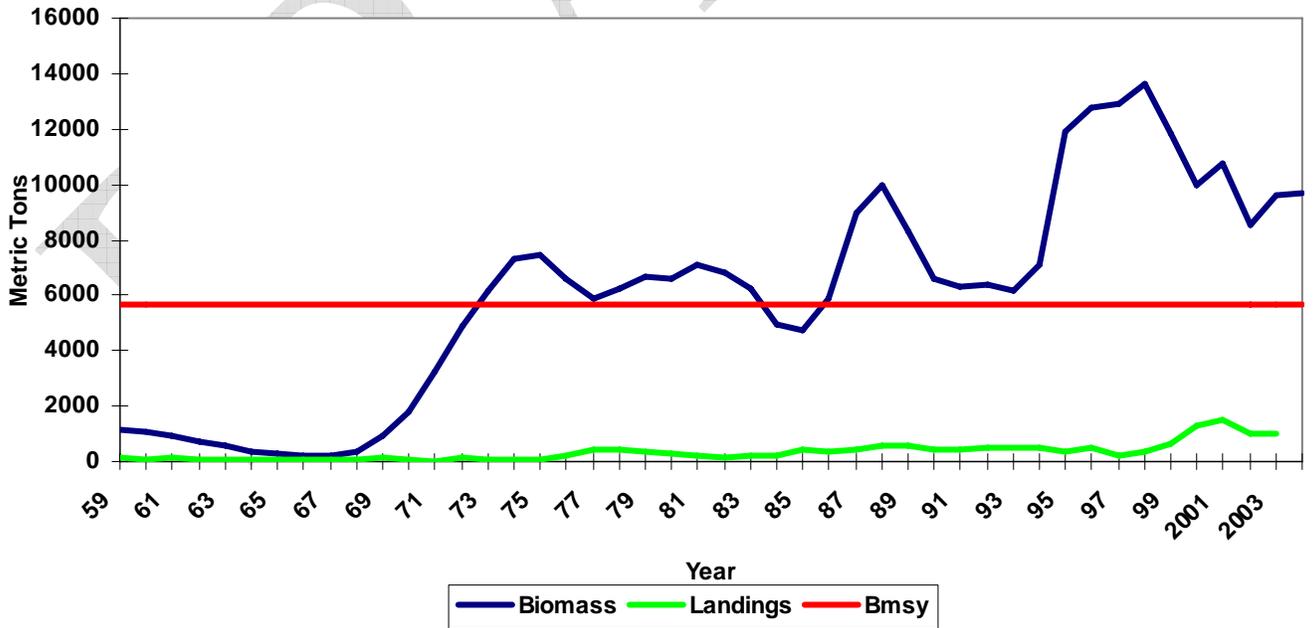


Fig.13- RI Horshoe Crab Fishing Mortality Rate Compared to MSY Reference Level

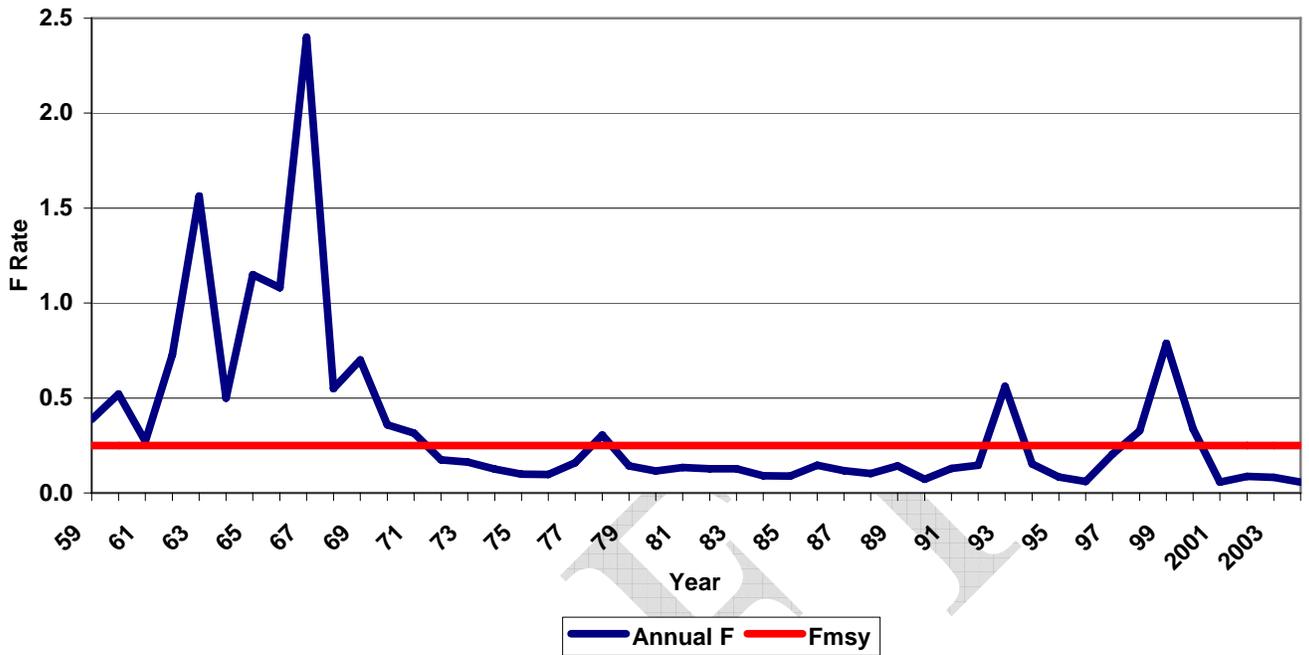
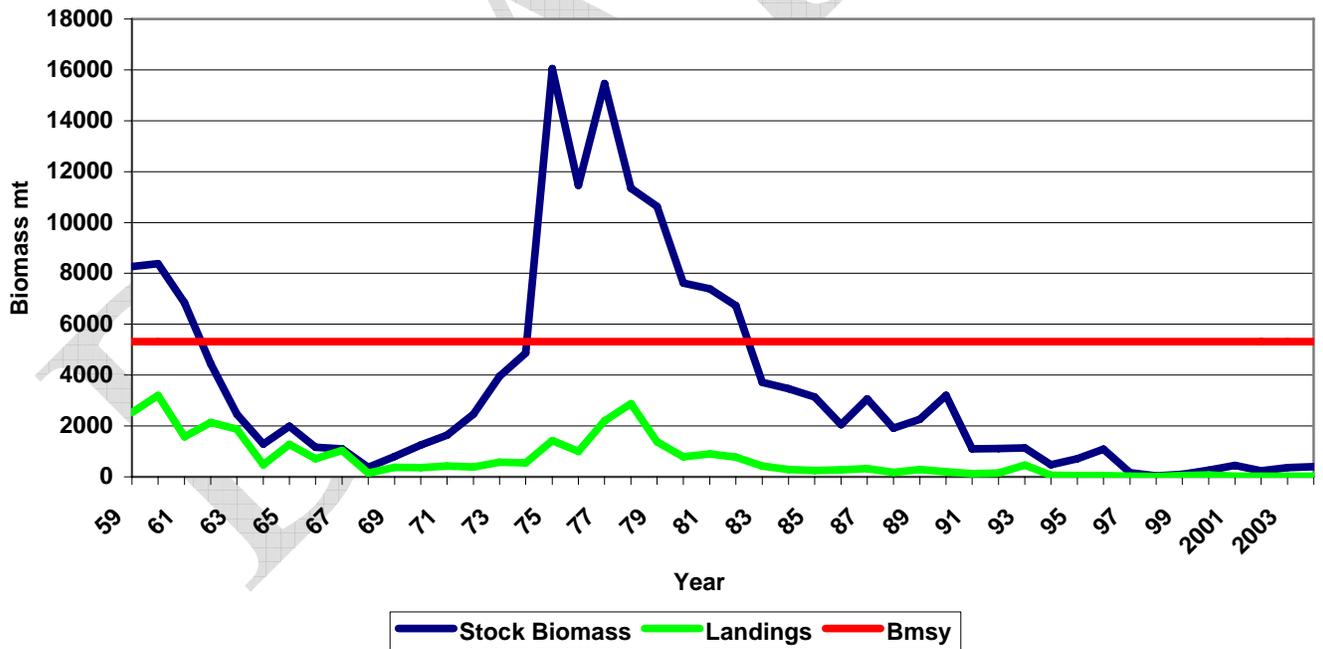


Fig.14- RI Horshoe Crab Abundance and Landings Compared to MSY Reference Level



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